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ABSTRACT

The document presents research and project-oriented activities at the secondary school level for studying Illinois' streams, water pollution, and methods for controlling pollution. Social, economic, and political issues are examined as part of the planning for pollution prevention. Following six teaching objectives, background information traces the development of federal water pollution legislation in the United States. Urban stormwater runoff, construction site erosion, coal mining, and soil erosion are described as major sources of water pollution. A student fact sheet on soil erosion is followed by a planning simulation exercise in which students role play state planners implementing water pollution controls. An activity sheet, designed for use with a road map, utilizes mathematics, geography, and the metric system in making students aware of streams in the area and their importance. Also included are suggestions for additional activities and for locating speakers, informational materials, or assistance in cleaning up a stream. (LH)

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CLEAN, SAFE WATER For How Long?

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Fastbacks are designed to promote the study of environmental problems by students in Illinois schools. Research and project-oriented activities are stressed. This fastback uses classroom and field work to study streams in Illinois, water pollution, and methods of controlling this pollution. Social, economic, and political issues are examined as a part of the planning for pollution prevention. Attitudes toward water pollution and its control are ambiguous. Everyone wants clean water. But when it comes down to actually achieving water quality, and the costs associated with cleaning up our water, attitudes begin to change. People begin asking such questions as: How much will it cost me to clean up our water supplies? How much will I benefit from this pollution prevention? Is it really worth all the money and efforts to have clean water?

Water pollution controls must satisfy certain basic requirements. First, they must result in clean water. Second, they must be economically, socially, and politically feasible. The issues involved in planning for water pollution controls are many and complex. We hope this fastback will help you and your class explore them.

OBJECTIVES

1. Realizing the importance of water in everyday life.
2. Exploring streams in the area and how these streams are used.
3. Exploring changes in water by natural and artificially-made means.
4. Identifying sources of water pollution and their effect on the environment.
5. Exploring the social, political, and economic effects of controlling water pollution.
6. Developing an informed opinion on water pollution and means to prevent or control pollution.

SE 011 737

Planning and distribution is a cooperative venture between Illinois Environmental Protection Agency and Illinois State Board of Education.

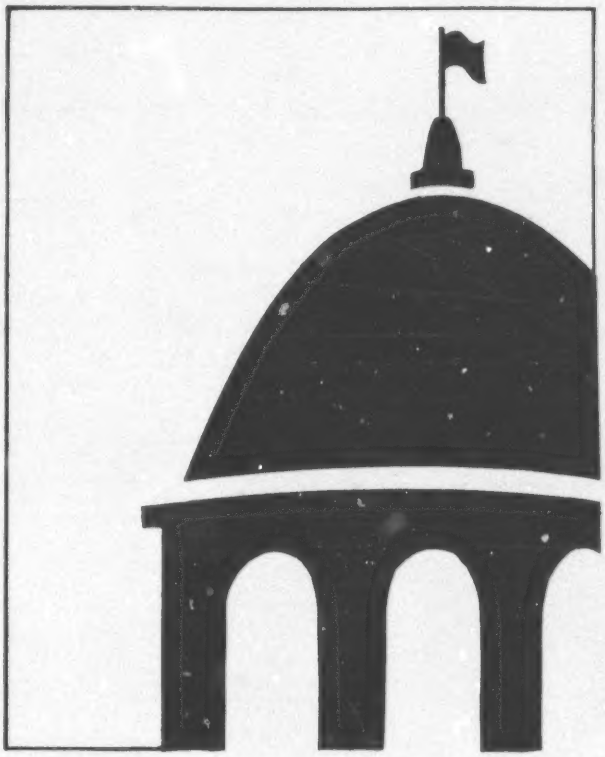
BACKGROUND INFORMATION

The State of Illinois is blessed with many streams and lakes. There are 14 major river basins, 2,700 interior streams, and 900 lakes in Illinois used for domestic and industrial water supplies, transportation, recreation, and commercial fishing.

The settlement of the state was governed by the abundant waters. Early settlers located villages along the streams and rivers. At this time, the waters of the state were clean and unpolluted by humans. As the population of the state grew, so did the range of humans. Industry and cities had to get rid of their wastes; rivers and streams received the discharge. The use of pesticides and fertilizers on agricultural land increased, and these compounds were carried by rainwater runoff into waters of the state. Lead from car exhausts and other pollutants found on city streets were washed into streams. And the intensified use of farmland to feed the world's population increased soil erosion and the sedimentation of rivers, lakes and streams.

Human activities have increased the load of impurities in water to such a degree that our rivers, lakes, and streams are, in many places, unsuitable for fishing, swimming, and drinking.

Photo by Dept. of Conservation



In the 1950's and 1960's people became concerned about the extent of water pollution. The U.S. Congress passed the Federal Water Pollution Control Act in 1956. This law allowed federal grants for the construction of municipal sewage treatment facilities. Industry began to treat its wastes before they were discharged into streams or rivers. In July, 1970, Illinois government formed the Illinois Environmental Protection Agency (IEPA). The federal government followed by forming the U.S. Environmental Protection Agency later in 1970. These agencies were given the responsibliity to clean up our waters.

In 1972, the U.S. Congress amended the Federal Water Pollution Control Act. As a result of these amendments, IEPA and interested citizens have addressed more thoroughly the problems of water pollution in Illinois streams and lakes. The goals in these 1972 amendments are to achieve fishable and swimmable waters by 1983.

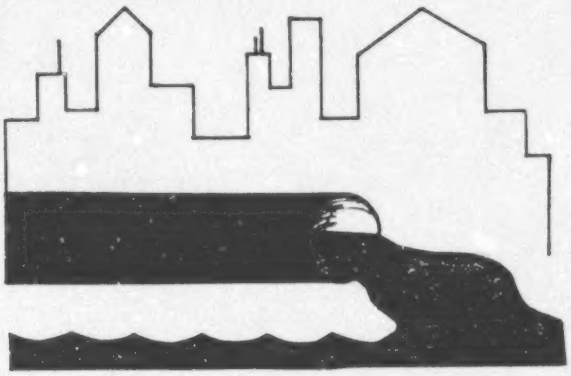
Historically, water pollution control has concentrated on clean-up tactics — treatment of polluted wastewater from industrial and domestic uses to render a usable substance.

Once the process of cleaning up after ourselves was well under way, it became logical to think about how water pollution could be prevented in the first place.

Section 208 of the amendments to the Federal Water Pollution Control Act deals with "non-point" sources of water pollution — those pollutants carried from large land areas by stormwater runoff. Non-point sources considered in Illinois' first 208 plan are urban stormwater runoff, mining, construction site erosion, and agriculture.

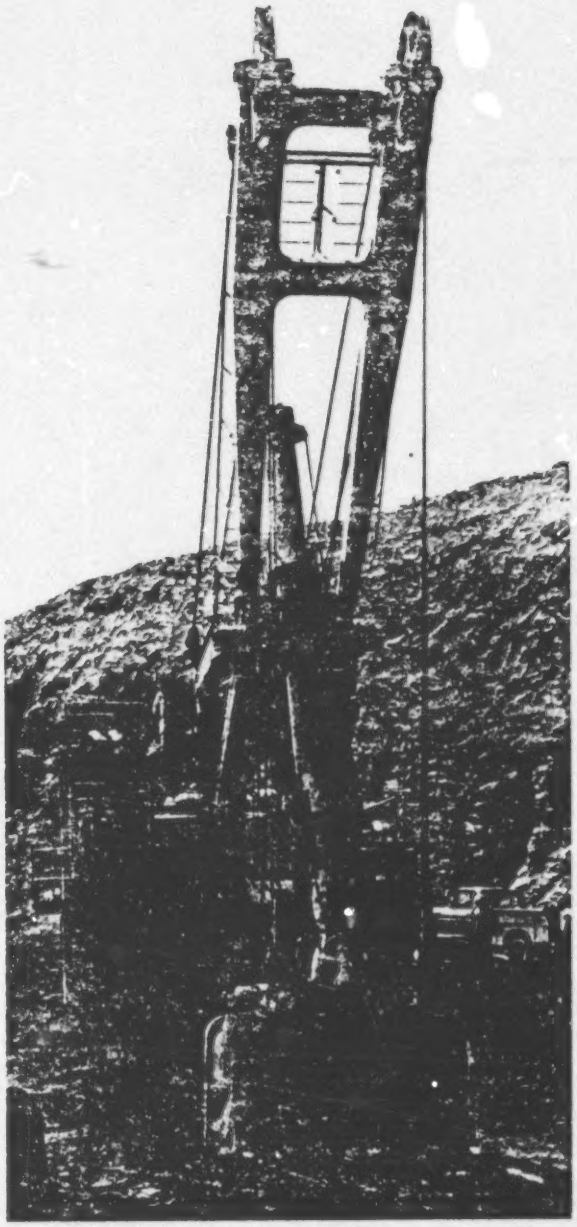
URBAN STORMWATER & POLLUTION

Urban stormwater runoff carries road salt, lead, oil and grease, and suspended solids into streams or lakes. These compounds are harmful to aquatic life, and in many cases, can be toxic. These materials must also be removed from water by treatment plants before the water can be used for domestic purposes.



CONSTRUCTION SITE EROSION

A large part of urban water pollution is sediment. And, although only two to three percent of the soil erosion statewide comes from construction sites, the highly localized problem can be ten times as severe as erosion from farmland. The problem is short-lived, but severe impacts can result on stream life and water quality. Erosion control programs in the future must focus on keeping disturbed areas as small as possible, keeping stormwater runoff velocities low and retaining sediment within the construction site.

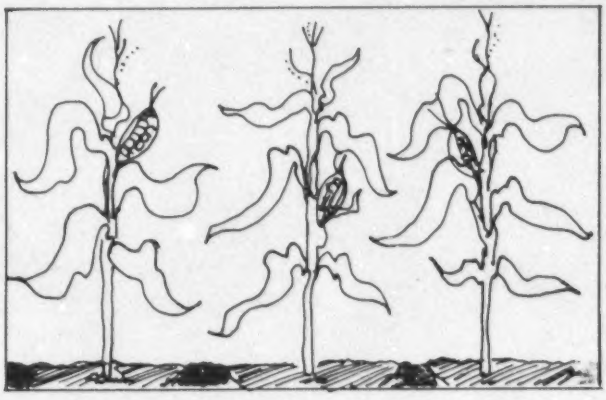


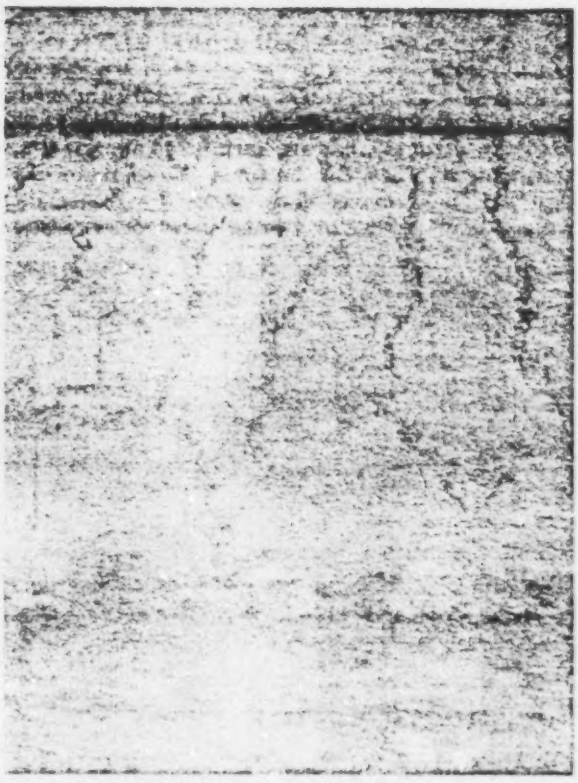
COAL MINING AND POLLUTION

Coal is a major economic resource in Illinois. Future removal of all stripable coal reserves in the state would affect approximately 2.6 million acres (7%) of Illinois land. Coal resources extend to 86 of Illinois' 120 counties. By 1976, 192,000 acres had been affected by surface mining operations. Water pollution comes from both active and abandoned surface and underground coal mines where acid mine drainage and sediment from erosion contaminates rivers and streams. Rainwater falling on mine refuse piles forms concentrated sulfuric acid, which is extremely damaging to aquatic life. Excessive corrosion of metal structures such as bridges can occur also.

SOIL EROSION AND POLLUTION

Studies over the past two years have shown that 199 million tons of soil erode annually in Illinois. Eighty-six percent comes from 32 million acres of agricultural land. Historically, erosion had slowly accelerated up to the 1930's as Illinois farmers turned more and more to planting row crops. After the dust storms of that era, more attention turned to erosion prevention, and erosion seemed to decrease slowly till 1970. Since then, however, farmers have greatly increased acreages of row crops, particularly soybeans, to meet world food demands, and erosion has increased 10%. In many parts in Illinois, over one-third of the original topsoil has been lost, hurting productivity. Over the past 100 years, productivity has been reduced 2.2 percent, yielding an annual loss of $110 million in Illinois crop production. The annual reoccurring cost from future erosion is $1.1 million. Over 8,000 acre-feet of storage capacity are lost each year due to sedimentation in Illinois public water supply reservoirs. Statewide, replacing the lost storage capacity in reservoirs would cost $17.7 million annually in terms of dredging or $3.1 million annually in terms of new lake construction. In addition, a 1978 survey of county highway superintendents and state highway maintenance engineers shows a minimum of $6.3 million being spent annually in order to remove sediment from roadside ditches and rights-of-way.

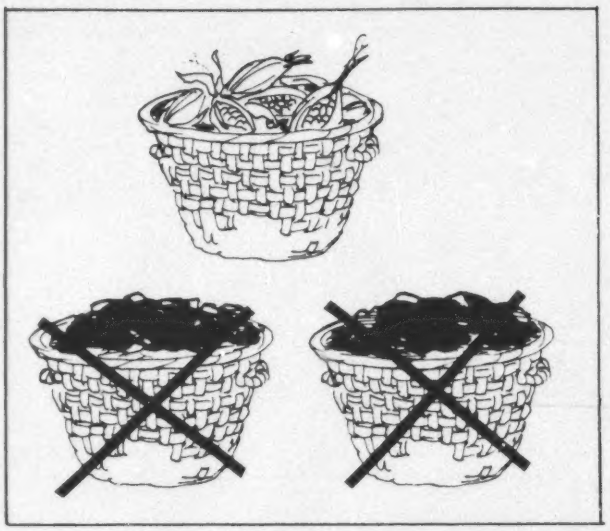


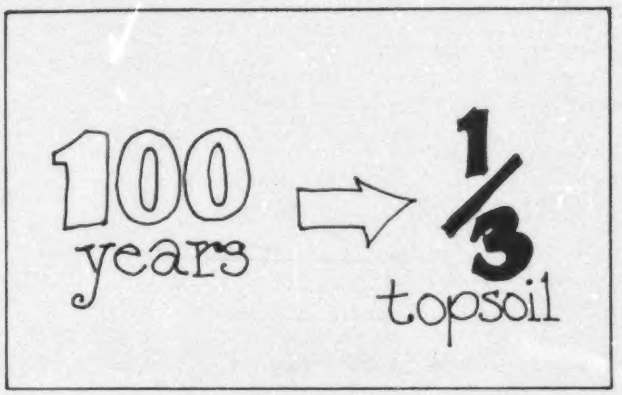


Other effects of soil erosion include plant nutrient losses, dredging for navigation purposes, loss of recreation areas, decreased property values adjoining sediment-filled lakes, decimation of fish and other aquatic life and lost aesthetic appeal. Additional pollution effects result when residual pesticides and plant nutrients (fertilizers) adhere to eroded soil particles and are transported to water bodies. Several Illinois lakes have been closed to commercial fishing due to high pesticide concentrations in fish. Approximately one-third of Illinois' major impoundments are adversely affected by heavy growth of aquatic weeds and algae, caused by surplus nutrients.

DID YOU KNOW AND DO YOU CARE???

That for every bushel of corn produced, there are two bushels of soil lost?





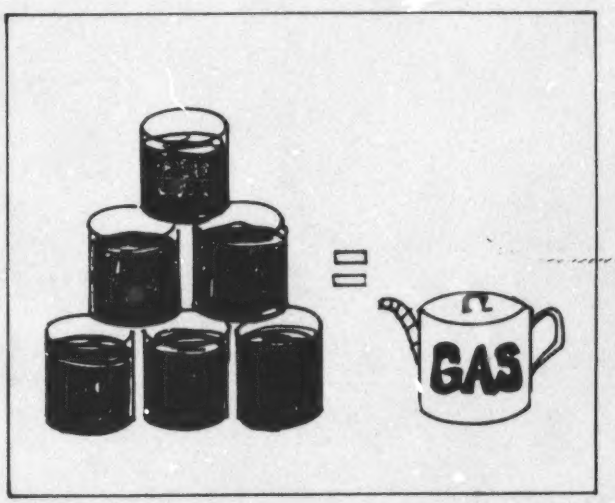
That in the last 100 years, Illinois has lost one-third of its topsoil?

That there are 160 million tons of soil eroded from agricultural land each year in Illinois? If this soil were stacked over the city of Chicago, it would be 230 feet high. How high would this 160 million tons be stacked over your city?

That the soil carried by the Mississippi River amounts to 15 tons of soil going past the city of New Orleans every **second**?

That it takes almost one ton of water to make one ton of paper?

That six gallons of water are used in oil refineries for every one gallon of gasoline produced?



EXAMINATION OF CLEAN WATER ISSUES

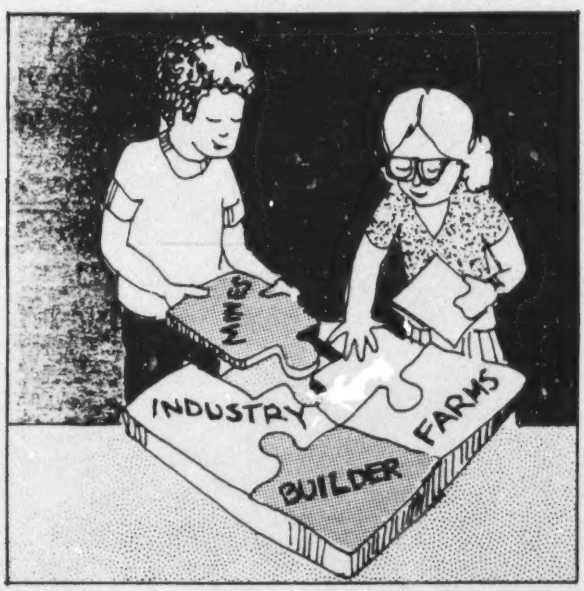
Note to teacher: *This is a planning simulation exercise for water pollution controls. Students are urged to role play and BE the planners for the state. Approximate time: 1 1/2 hours.*

MATERIALS NEEDED: Blackboard, easel with large pad of paper, marking pens.

1. Ask students to name sources of water pollution. List these on a blackboard. (Examples: pesticides, runoff from city streets and parking lots, domestic sewage, industrial wastes, fertilizers, soil erosion, runoff from mines, construction site runoff, litter, etc.)

2. Divide these sources of water pollution into major categories based on social groups in your community. For example, construction businesses and homebuilders would be interested in construction site runoff; farmers would be interested in pesticides, fertilizers, and soil erosion; industries would be concerned with industrial sources of water pollution. Divide the class into groups, appointing them as the planning agency for agriculture, industry, construction sites, mining, etc.

3. Ask each group to list the water pollution problems they cause, the economic problems in solving their source of pollution, who would be affected, and how to control their source of water pollution. Have them use a visual aid.



4. Each group will appoint a leader, who will present the results of activity #3 to the whole class through the use of the visual aid.

5. Between presentations in #4, point out conflicts in controlling sources of pollution — (example — if industry installs water pollution control devices, the cost of this must be passed on to the consumer. What will the consumer say? To control soil erosion from agriculture may mean extra costs to the farmer — unlike industry, he cannot pass on the costs to the consumers. What will the farmer do?)

6. Ask each group to develop a comprehensive plan based on all of the presentations.

7. Ask each group to present their plan to the class. Discuss differences, similarities, etc. Point out that planning for the control of water pollution goes through the same process, and must take into consideration political, economic, environmental, and social factors. Planning for water pollution abatement isn't a simple process, is it?

NOTE: ***The activity sheet on the following page is designed to make students aware of streams in the state and their importance. The activity sheet utilizes mathematics, geography, and the metric system. Materials needed for the activity sheet: State of Illinois road map and ruler. Approximate time: 1 hour.***

ACTIVITY SHEET

1. How many streams or rivers are located in a 50-mile radius from your school? Name them.

_____

_____

_____

_____

_____

2. Which of these streams is the longest?

_____

The longest stream is ____ miles long _____ or kilometers long.

3. How many towns with a population of 5,000 or more does the longest stream pass through? _____ List the towns below:

_____

_____

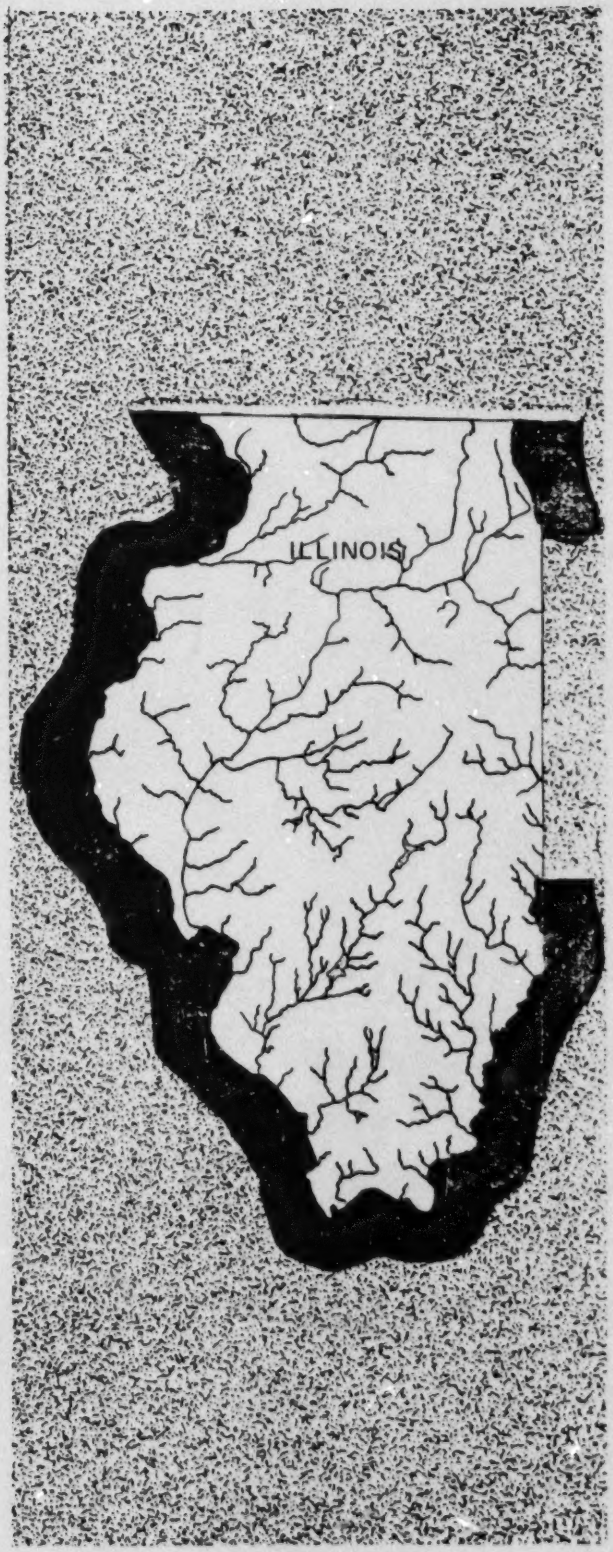
_____

_____

_____

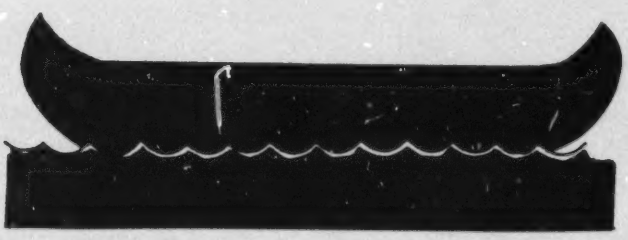
_____

_____



4. Measure the length of the Mississippi River along the Illinois border. It is ____ miles or _____ kilometers long.

5. Approximately how many gallons of water do you use each day? ____ How many liters is this? _____



6. How many of the streams or rivers within a 50-mile radius of your school are used for?

Swimming _____
Boating _____
Fishing _____
Canoeing _____

7. How many highways cross the Illinois River between Henry and Beardstown? _____

ACTIVITIES, continued

8. How many State Parks, State Memorials, Historic Sites, or Conservation Areas are located along rivers or streams? _____
List them below:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

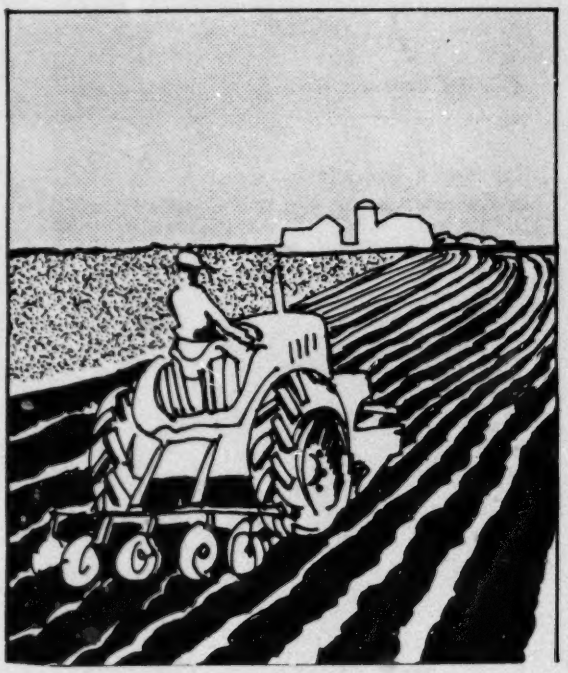
Photo by Dept. of Conservation

9. In Illinois each year, there are 199 million tons of soil lost through the erosion process. How many metric tons is this? _____

10. Of this 199 million tons, 86% comes from agricultural land. How many tons of soil are eroded from agricultural land? _____ How many metric tons is this? _____

11. There are 29 million acres of agricultural land in Illinois. How many hectares is this? _____

12. What is the average soil loss in tons per acre per year from agricultural land? _____
How many metric tons per hectare is this? _____



13. How many Soil and Water Conservation District Cooperators are there in your county? _____

14. List four (4) conservation practices farmers use to help control soil erosion.

_____

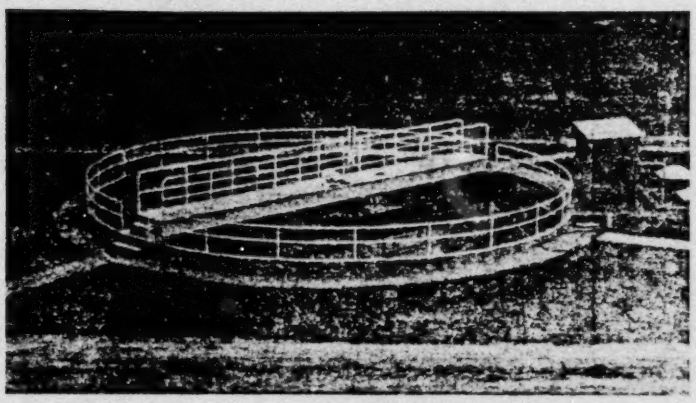
_____

_____

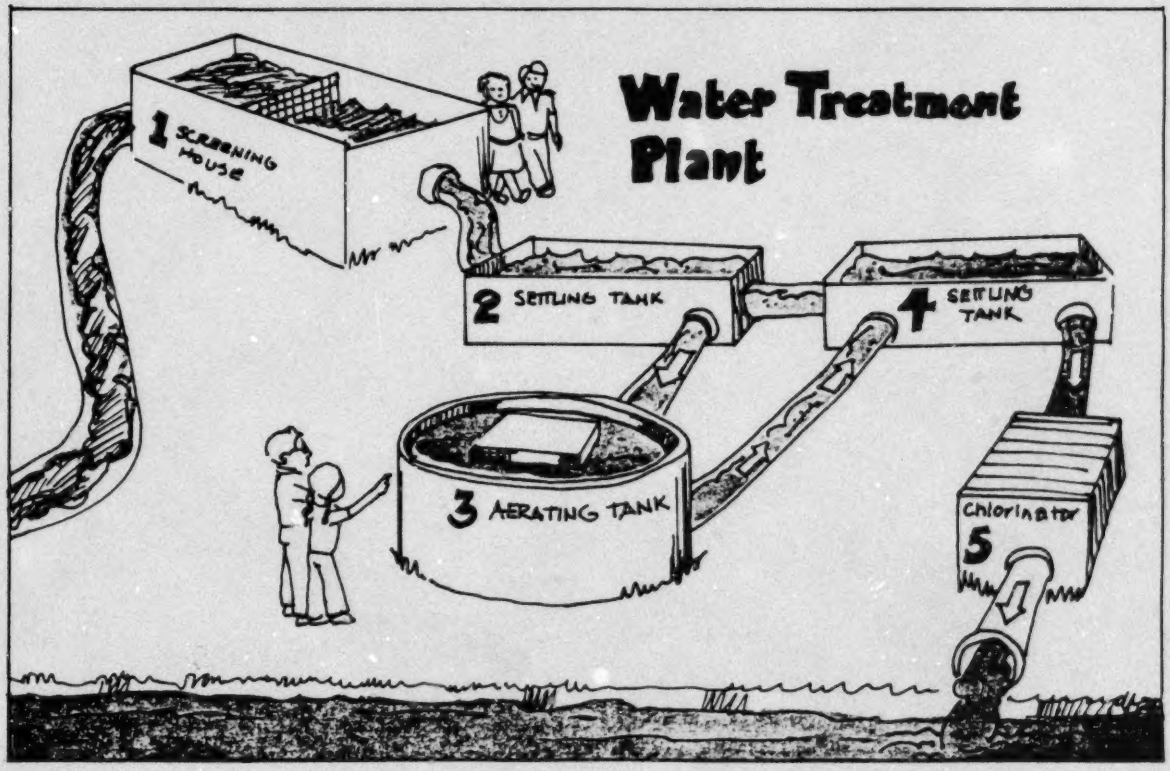
_____

SUGGESTED ACTIVITIES

1. Visit your local sewage treatment facility.



2. Visit your city's water treatment facility.



3. Visit a stream or lake near your school. Materials needed: Drawing paper, notebook paper. Student can: draw a picture using only materials and colors found in or around the water; find five living organisms, watch them, and identify them and their activities; write a haiku (short poem) about the steam or lake.

4. Visit a farm that controls agricultural sources of water pollution. Your local Soil and Water Conservation District or Soil Conservation Service can help you arrange a tour.

5. RAINDROP IMPACT ON SOIL EROSION

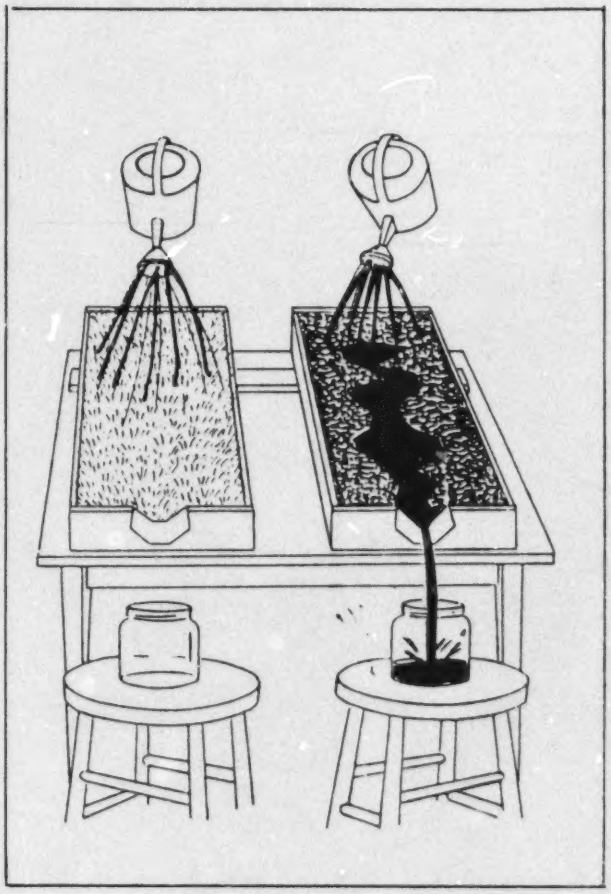
Materials needed: 2 wooden stakes, approximately 107 centimeters long (3 1/2 feet) and 10 centimeters wide (4 inches) - painted white. Sprinkling can.

Locate two adjacent spots on the schoolgrounds with different amounts of grass cover. (Suggestions — one with heavy sod, and one area with no grass cover; one area of cropland or garden crops, and one with sod cover). Place stakes in the ground and use the sprinkling can to simulate rainfall. Note the height of soil particles splashed on the stakes and the amount of soil splashed from each area. The raindrop impact loosens soil particles. After the particles are loosened, they are then able to be carried by water runoff.

6. WATER RUNOFF AND SOIL EROSION

Materials needed: Two waterproof boxes about 41 centimeters long (16 inches), 31 centimeters wide (12 inches), and 10 centimeters deep (4 inches). At one end of each box, cut a V-notch. Two fruit jars. Two sprinkling cans.

Fill both boxes with soil, leaving one box with no vegetation, and the second box with sod cover. Place boxes on an angle with the notched end being the lower end. Place the jars under the notches to catch runoff water. Use the sprinkling cans to simulate rainfall. By comparing the runoff water caught in the jars, determine which box lost the most soil and why. Further experiments can be done with the boxes. Using two boxes of soil with no vegetation, make small ridges (terraces) across the slope on one box, leaving the other bare or place straw mulch on the soil in one box, leaving the second box with bare soil. Compare runoff from each different "field".



OTHER RESOURCES

This material has been prepared by Pam Zenke, Illinois Environmental Protection Agency, as one part of a series of teaching units on natural resource management. For information about others in this series or to obtain additional copies, please write the Illinois State Board of Education, 100 North First Street, Springfield, Illinois 62777. Users are urged to copy and reproduce this material for local use, giving proper credit.

If you are interested in learning more about our water pollution problem and how it affects the environment, contact any of the following:

FOR SPEAKERS OR INFORMATIONAL MATERIALS, CONTACT AN ENVIRONMENTAL PROTECTION AGENCY CLEAN WATER PLANNING COORDINATOR -

Public Participation Coordinator
815/987-7755
4302 North Main Street
Post Office Box 915
Rockford, IL 61103

Public Participation Coordinator
618/997-4371
117 West Main
Collinsville, IL 62234

Public Participation Coordinator
217/333-8361
2125 South First Street
Champaign, IL 61820

Public Participation Coordinator
312/345-9780
1701 First Avenue
Maywood, IL 60153

Public Participation Coordinator
217/782-3397
2200 Churchill Road
Springfield, IL 62706

FOR ASSISTANCE IN CLEANING UP A STREAM, CONTACT A CONSERVATION DEPARTMENT FISHERIES BIOLOGIST-

Gary Erickson 815/675-2385
Rural Route 1, Box 340
Libertyville, IL 60048

Pete Paladino 618/462-1181
34 West Broadway
Alton, IL 62002

Leo Rock 815/625-2968
Post Office Box 708
Rock Falls, IL 61701

Mike Conlin 217/782-6426
100 East Washington
Springfield, IL 62706

OTHER RESOURCES AND REFERENCES:

Izaak Walton League of America
National Office
1800 North Kent Street, Suite 806
Arlington, VA 22209

U.S.D.A. Soil Conservation Service
Located in each county

"Teaching Soil and Water Conservation: A Classroom and Field Guide" (PA-341)

"An Outline for Teaching Soil and Water Conservation in Elementary Schools" (PA-268)

Soil Conservation Society of America
7515 Northeast Ankeny Road
Ankeny, IA 50021

"The Wonder of Water"

"People and Their Environment" — Teacher's Curriculum Guide to Conservation Education
Published by:
J. C. Ferguson Publishing Company
111 East Wacker Drive
Chicago, IL 60601

Local Soil and Water Conservation District
They have films and slides, speakers, and materials on soil erosion and sedimentation.

U.S. Environmental Protection Agency
230 South Dearborn Street
Chicago, IL 60604

"Earth-Trek"

Bibliography

Izaak Walton League of America — Planning Simulation Exercise.

USDA - SCS "Teaching Soil and Water Conservation: A Classroom and Field Guide."

"Illinois Sheet and Rill Erosion."

Illinois Environmental Protection Agency — "Clean Water Horizons," January, 1979.

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ILLINOIS EPA Environmental Protection Agency

Illinois State Board of Education